

Total No. of Questions—12]

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[3762]-707

S.E. (Production/Production S/W/Industrial Engineering)

(Second Semester) EXAMINATION, 2010

DESIGN OF MACHINE ELEMENTS

(2003 COURSE)

Time : Three Hours

Maximum Marks : 100

- N.B. :-**
- (i) Answer any *three* questions from each Section.
 - (ii) Answers to the two Sections should be written in separate answer-books.
 - (iii) Neat diagrams must be drawn wherever necessary.
 - (iv) Figures to the right indicate full marks.
 - (v) Assume suitable data, if necessary.

SECTION I

1. (a) Explain the various stages in design of any machine element. [6]
- (b) Explain the variation of strain with respect to ductile and brittle material. [6]
- (c) What are the requisites of Design engineer ? [4]

P.T.O.

Or

2. (a) Explain the weighted parameter method for selection of material. [6]
- (b) What is design analysis and design synthesis ? [4]
- (c) Write a short note on preferred numbers. [6]
3. (a) Explain design procedure for angular lever. [6]
- (b) The effective length of hand lever is 1 M. The effective overhang from the Nearest bearing is 150 mm. The lever and shaft is made of alloy steel for which tensile yield strength is 460 N/mm^2 . If the maximum force exerted at Handle is 300 N, design the lever and shaft with factor of safety 4. [10]
4. (a) Draw the neat diagram of knuckle joint. [6]
- (b) Design the cotter joint to transmit a load of 100 kN in tension or compression. Assume the following stresses for socket, spigot and cotter :
- (i) Allowable tensile stress = 90 N/mm^2
- (ii) Allowable crushing stress = 170 N/mm^2
- (iii) Allowable shear stress = 60 N/mm^2 [10]

5. (a) Explain various types of springs with their neat sketch, application advantages. [6]

(b) Compare the weights of equal length of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both the shaft is same and inside diameter is $\frac{2}{3}$ of outside diameter for hollow shaft. [6]

(c) Write a short note on Bush type Coupling. [6]

Or

6. (a) Write a short note on Wahl stress factor. [6]

(b) Design a helical compression spring for a maximum load of 1200 kN for deflection of 25 mm using the value of spring index as 5. Assume Maximum permissible shear stress for spring material as 400 N/mm^2 . Modulus of rigidity can be assumed as 85 GN/mm^2 . [12]

SECTION II

7. (a) Compare the riveted joints and welded joints. [4]

(b) Draw the different types of thread forms. [2]

(c) The following data is given for screw jack.

(i) Nominal diameter of the shaft of screw : 40 mm

(ii) Pitch of square threads : 7 mm

(iii) Coefficient of thread friction : 0.15

(iv) Coefficient of collar friction : 0.1

(v) Effective mean diameter of collar : 70 mm

The operator can comfortably exert a force of 150 kN at radius of 1.2 m to raise the load assuming single start threads. Calculate the maximum load can be lifted, the efficiency of the screw and the overall efficiency. [10]

Or

8. (a) Draw the welded joints along with the examples. [6]
- (b) A steel angle is welded to a steel plate by the filler welds l_1 and l_2 of length 200 mm each. The leg size is 10 mm. If the permissible shear stress for the weld is 80 N/mm^2 , calculate the load carrying capacity of weld connection. [6]
- (c) Justify the use of reticulating ball lead screw in CNC machine. [4]
9. (a) Define the clutch. Write a short note on positive Clutch. [6]
- (b) A single plate clutch consisting of two pairs of contacting surfaces is required to transmit 40 kW power 1560 r.p.m. The coefficient of friction between the contacting surfaces is 0.3 and the intensity of pressure is limited to 0.4 N/mm^2 . The outer diameter of the friction disk is limited to 300 r.p.m. if the service factor is 1.25, determine the inner diameter of the friction disk and axial force required to engage the clutch. [10]

Or

10. (a) State the different types of brakes and the explain application of each. [6]

(b) A pivoted double block brake has two shoes each of which sub stand an angle of 120° at center of brake drum. The diameter of the brake drum is 450 mm and the width of the friction lining is 75 mm. The coefficient of friction is 0.2 and the maximum intensity of pressure between the lining and the brake drum is 0.5 N/m^2 , the pivot of each shoe is located in such a manner that the amount of friction force on shoe about the pivot is Zero. Assuming that the same actuating force is applied on both shoes, calculate distance of pivot from the axis, braking torque capacity of brake and pivot reaction. [10]

11. (a) How will you select the belt from the Manufacturers Catalogue. [6]

(b) An exhaust fan fitted with 900 mm diameter pulley is driven by open type flat belt from a 30 kW, 1000 r.p.m. electric motor. The pulley on the motor shaft 250 mm in diameter and the center distance between the shaft and the motor shaft is 2.5 m. The allowable tensile stress for the belt material

is 2 N/mm^2 and the coefficient of friction between belt and pulley is 0.25. The density of belt material is 950 kg/m^3 . If the width of belt is 100 mm. Determine Thickness of belt, length of belt and initial tension required in the belt. [12]

Or

12. (a) State the advantages and disadvantages of flat and V-belt drives. [6]

(b) A rope drive is used to drive to transmit 260 kW power from a 300 mm pitch diameter pulley rotating at 1000 r.p.m. to 600 mm pitch diameter pulley. The pulley groove the angle 45° and the center distance is 6 m. The mass of the rope is 3.2 kg per meter and the coefficient of friction between the rope and the pulley is 0.3. If the permissible pull for each rope is 2000 N, determine the number of rope required. [12]

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